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(54) [Title of the Invention] IMAGE FORMING APPARATUS

(57) **[Abstract]**

[Problem to be solved] To provide a copier capable of reproducing images with high quality.

[Solution] This copier forms an electrostatic latent image on a photosensitive body based on control of a light quantity by using a plurality of solid scanning devices each of which corresponds to respective pixels. A light-quantity-unevenness sensor 23 can detect a light quantity of each pixel corresponding to a solid scanning device. The light-quantity- unevenness sensor 23 is attached to a screen shaft 30. The screen shaft 30 is rotated by a sensor moving motor M1, then the light-quantity-unevenness sensor 23 is moved in an arrangement direction of the solid scanning devices 17 (direction of arrow c). In this copier, the light quantity for forming the image is corrected based on the detection result of the light-quantity-unevenness.

[What Is Claimed Is]

[Claim] An image forming apparatus for forming an image by controlling light quantity of a plurality of solid scanning devices each of which corresponds to respective pixels, the image forming apparatus comprising:

detecting means for detecting light quantities of the solid scanning devices;

moving means for moving the detecting means in an arrangement direction of the solid scanning devices; and

light quantity correcting means for correcting light quantities of the solid scanning devices in response to a light quantity detected by the detecting means which is moved by the moving means.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] The present invention relates to an image forming device which forms an image by controlling a light quantity obtained by plurality of solid scanning devices.

[0002]

[Field of the Invention] Conventionally, digital image forming devices have been used for forming images. In such digital image forming devices, image data of original manuscript read by an image reader or image data obtained from external of the devices via data transmitting path are stored an image memory. The image data are converted into printing data at a printing section. Then, the digital optical system in the printing section exposes a photosensitive body to form an electrostatic latent image thereon based on the printing data. The electrostatic latent image gets developed and an image is finally formed on a printing medium.

[0003] In digital image forming devices, image exposure to the photosensitive body is exercised by unit of pixels to form an electrostatic latent image. In this manner of image exposure, exposure amount varies in accordance with emission time within a unit of pixels and half tone can be reproduced by controlling emission time.

[0004] As a printer head for image exposure to a photosensitive body, optical scanning devices such as laser and solid scanning devices such as LED, liquid crystal shutter, PLZT and the like are used.

[0005] Since a printer head employing solid scanning devices does not need rotating members such as polygon motor typically used for optical scanning devices, high reliability is realized. Furthermore, the solid scanning device type printer head has many advantages such as that no noise is made while standing-by and that printer head can be miniaturized.

[0006] Details of a printer head provided with solid scanning device will be described by referring to Figs. 11 to 14. Fig. 11 is a diagram for illustrating operation of each section of a printer head using the solid scanning devices.

[0007] A printer head 60 exposes to a photosensitive body 68. The printer head 60 comprises a light source 61, an optical fiber 62, a rod lens 63, a polarizer 64, a light shutter array (solid scanning device) 65, an analyzer 66, and a rod lens array 67.

[0008] Light emitted from the light source 61 passes through the optical fiber 62 in a bundle of linear rays and reaches the rod lens 63. The bundle of linear rays is condensed by the rod lens 63 and then, condensed onto the light shutter array 65 via the polarizer 64. Incident lights have random polarzing surface and the polarizer 64 allows only the incident lights having a certain polarizing direction to pass there selectively.

[0009] The light that has passed the polarizer 64 reaches the light shutter array 65. The light shutter array 65 consists of light shutter element arranged with units of tiny

pixels and the light shutter element has electro-optical effect. When voltage is applied to the light shutter element, the device allows light to pass there by rotating polarizing surface of the incident light. If no voltage is applied thereto, the light shutter element allows light to pass there without changing polarizing surface of the incident light.

[0010] Polarizing surface of light having a certain polarizing direction rotates with the aid of the polarizer 64 only when voltage is applied to the light shutter element. Due to the rotation of the polarizing surface, light that has passed through the polarizer 64 passes through the analyzer 66 which deflects against the polarizer 64 by 90 degrees. Light that has passed through the analyzer 66 is focused by the rod lens array 67 and then, irradiated onto the photosensitive body 68 uniformly charged.

[0011] Such irradiation (exposure) of light is exercised based on printing data. Rotation of the photosensitive body 68 and irradiation are synchronized for each other whereby an electrostatic latent image can be formed on the photosensitive body 68. After that, development and image transfer are made following typical electrophotographing technique, and an outputted image is finally obtained.

[0012] When an electrostatic latent image is formed onto the photosensitive body, the above-mentioned light shutter array 65 is driven as follows.

[0013] Fig. 12 is a diagram showing a light shutter driving circuit for driving a light shutter array 65 and Fig. 13 is a diagram for illustrating relationship between drive pulse voltage to be applied to the light shutter element in the light shutter driving circuit and light intensity of light which passes the light shutter element.

[0014] The light shutter driving circuit for driving the light shutter array 65 constituted with a plurality of light shutter elements includes a shift register 71, a latch circuit 72, and a driver 73.

[0015] An image data DATA is transferred to the shift register 71 synchronizing with a clock signal CLK. The image data DATA is latched by a latch strobe signal LS at a latch circuit. A BLK signal is turned on/off and then, the driver 73 applies drive pulse voltage VD to each light shutter element of each light shutter array 63 in accordance with signals sent from the latch circuit. As shown in Fig. 13, during time T when drive pulse voltage VD is applied, as for the light passing the analyzer through each light shutter element, light intensity Id changes into light intensity Ip so that on/off of each of the light shutter elements should be controlled.

[0016] Fig. 14 shows relationship between voltage V to be applied to the light shutter element and transmitted light intensity I of light which has passed an analyzer.

[0017] In the graph of Fig. 14, the vertical axis and the horizontal axis represent voltage V for driving light shutter elements and transmitted light intensity I of light

which has passed an analyzer, respectively. Transmitted light intensity I has its maximum value when a voltage that deflects transmitted light in 90 degrees is applied to the light shutter elements. This voltage is half-wave length voltage VH/2. The drive pulse voltage VD mentioned in Figs. 12 and 13 is normally set to half-wave length voltage. By controlling time T when drive pulse voltage VD is applied, open/close time of the light shutter is changed. Thereby, exposure amount is controlled. Adjustment of exposure amount realizes reproduction of half tone images.

[0018] In an image forming device employing with light shutter elements, single pixel corresponds to single light shutter element and several hundreds of light shutter elements are used therein. Theses light shutter elements do not work uniformly. Therefore, even though same character data (image data) is used, obtained exposure amount differs case by case, whereby unevenness of light quantity obtained is caused.

[0019] Conventionally, the unevenness of light quantity is measured when parts of an image forming apparatus are put together and the above-mentioned driver or other devices therein are adjusted so that light quantity for the same character data should be uniform in arrangement direction. More specifically, unevenness of light quantity is measured with respect to maximum light quantity.

[0020]

[Problem to be Solved by the Invention] However, even if adjustment such as above is made when parts of the image forming device are put together, durability characteristic and temperature characteristics of each light shutter element cause unevenness of light quantity. In the event, unevenness of light quantity cannot be prevented even if the device is adjusted when the parts are put together. For example, even if drive pulse voltage VD is set to be half-wave length voltage under room air temperature, in case that integrated circuits at the vicinity of the light shutter array generate heat to make temperature of the light shutter element go up, light intensity of light that passes the light shutter element decreases and so does exposure amount to the photosensitive body,. As a result, smoke of toner occurs when the printer head is used as a recording head.

[0021] Furthermore, eve if adjustment such as above is made for the printer head, drive voltage required to obtain maximum transmitted light intensity is subtly different by each light shutter element due to shutter characteristic variation of each light shutter element or dirt thereof.

[0022] Fig. 15 is a diagram showing variation of light quantities obtained through the light shutter element. Light quantity obtained by a light shutter array A and light quantity by a light shutter array B are different. Further, even though it is within a

light shutter array, light quantities obtained by respective light shutter elements have variation.

[0023] Since only maximum light quantity is measured so as to adjust unevenness of light quantity, image output based on binary image data has no particular problem. However, as to half-tone image output, open/close time of light shutter elements is controlled to obtain image data based on more than binary number, which results in unevenness of light quantity in half-tone image.

[0024] As described in the above, since light quantity (or light intensity of light to be irradiated on a photosensitive body for exposure via light shutter array varies among respective light shutter elements, image with high quality cannot be obtained in conventional image forming apparatuses.

[0025] The object of the present invention is to provide a copier capable of reproducing images with high quality.

[0026]

[Means for Solving the Problem] The invention set forth in claim **1** relates to an image forming apparatus for forming an image by controlling light quantity of a plurality of solid scanning devices each of which corresponds to respective pixels.

[0027] The inventive image forming apparatus comprises: detecting means for detecting light quantities of the solid scanning devices; moving means for moving the detecting means in an arrangement direction of the solid scanning devices; and light quantity correcting means for correcting light quantities of the solid scanning devices in response to a light quantity detected by the detecting means which is moved by the moving means.

[0028] According to the invention set forth in claim **1**, the detecting means is moved in a arrangement direction of the solid scanning devices to detect light quantity from each of the solid scanning devices. Then, light quantities of the solid scanning devices are corrected in accordance with detected light quantity. Thereby, it is not necessary to consider characteristics variation of detecting means which is due to use of a plurality of detecting means for light quantity measurement. Since light quantity can be corrected depending on each of the plurality of solid scanning devices, image with high quality can be obtained even if light quantities obtained from the solid scanning devices are not uniform for some reason.

[0029]

[Preferred Embodiments] One of the aspects of the present invention, which is a copier using solid scanning devices for its printer head, will be described by referring to drawings.

[0030] Fig. 1 is a cross sectional diagram showing a schematic structure of a copier which employs solid scanning devices for its printer head.

[0031] In this copier, an image is formed as follows. An original manuscript placed on an original glass plate 11 is exposed by an exposure lamp13 along with movement of image reader unit 12. Reflected light on the original is irradiated on a line sensor 15 via a lens array 14. Image signals obtained by the reflected light on the original is converted into electrical signals by the line sensor 15, then, sent to the solid scanning devices 17 as image data while being controlled by the printer control section.

[0032] The solid scanning device 17 exposes to the photosensitive body 21 uniformly charged by the charger 18 in accordance with the image data to from a static image corresponding to the manuscript image on the photosensitive body. Image exposure is carried out per unit of pixels. Half tone is reproduced such that emission time is controlled for each unit of pixels to vary exposure amount to the unit of pixels. This electrostatic latent image is moved in the arrow a direction along with rotations of the photosensitive body 21 and then, gets developed by the developer 22.

[0033] On the other hand, a copying medium fed out from a paper feeding tray 24 is sent to a timing roller 25 along with a transmission path. The timing roller 25 sends the copying medium outside synchronizing with the toner image on the photosensitive body 21. The copying paper sent out from the transmission path is moved in the arrow b direction by transfer belt 27 and reaches transcription section.

[0034] There is provided a transcript charger in the transcription section and a developed toner image is copied onto the copying medium at a portion where the transcript charger 26 faces the photosensitive body. The copying medium gets apart from the transfer belt 27 and delivered to the fixer 28. The toner image is fixed by the fixer 28 and then, ejected onto an original ejection tray 29.

[0035] The photosensitive body 21 keeps running in the arrow a direction even after development. A cleaner 20 removes toner remaining on the photosensitive body 21 and a main eraser 19 eliminates remaining charge to provide for next development.

[0036] Fig. 2 is a block diagram for illustrating how an image signal is processed from the line sensor15 of Fig. 1 through the solid scanning devices 17.

[0037] A user gives operation instructions to a printer control section 16 by means of an operation section 51. The printer control section 16 controls a γ-correction section 54 based on image data supplied from a line sensor 15 and correction data from a light-quantity-unevenness sensor 23. The printer control section 16 further controls emission signal generating section 58 thereby to control a D/A converting section 55.

[0038] In the line sensor 15, electric signals are generated based on light reflected

from manuscript irradiated. The electric signals of the manuscript information are first converted into digital data by an A/D converting section 51, applied image processing thereto by an image processing section 52 and then, stored in an image data memory 53. The γ-correction section 54 applies γ-correction to the image data stored in the mage data memory 53 based on γ-data in a γ-data ROM 59.

[0039] On the other hand, electric signals of light-quantity-unevenness information are converted into digital data by a light-quantity-unevenness A/D converting section 60 and stored in a light-quantity-unevenness memory 61. The light-quantity-unevenness data create a light quantity correction table 63 with the aid of a processing unit 62.

[0040] The image data with being γ-correction applied are further corrected by the light quantity correction table 63 and then, converted into analog data by the D/A converting section 55. Based on the thus obtained image data, an optical system controlling section controls the solid scanning devices 17.

[0041] Next, details of the light-quantity-unevenness sensor 23 will be described by referring to Figs. 3-6. Fig. 3 is a diagram for illustrating a schematic structure at the vicinity of the solid scanning devices 17 and light-quantity-unevenness sensor 23 and Fig. 4 is a diagram showing the solid canning devices 17 of Fig. 3 arranged in a staggered form.

[0042] The solid scanning devices 17 is such that a plurality of emission elements or light shutter elements are arranged in a row or in a staggered form as shown in Fig. 4. Furthermore, one of the emission elements or the light shutter elements in a arrangement direction corresponds to a pixel. In order to detect light-quantity-unevenness of the solid scanning devices, the light-quantity-unevenness sensor 23 is disposed at the vicinity of the solid scanning devices 17

[0043] The light-quantity-unevenness sensor 23 in this embodiment employs a photoreceptive sensor such as photo-diode. The light-quantity-unevenness sensor 23 can move in the arrangement direction of the solid scanning devices 17 (in arrow c direction) and detect light quantity of a pixel corresponding to each of the solid scanning devices.

[0044] The light-quantity-unevenness sensor 23 is attached on a screen shaft 30. The screen shaft 30 is rotated by a sensor moving motor M1 and together with the screen shaft 30, the light-quantity-unevenness sensor 23 moves. The light-quantity-unevenness sensor 23 detects unevenness of light quantity with predetermined timing.

[0045] Figs. 5 and 6 are diagrams showing the light-quantity-unevenness sensor 23 in detecting operation and the solid scanning devices 17.

[0046] When unevenness of light quantity is detected, the solid scanning devices

17 are to be moved to positions as shown in Fig. 5 wherein the solid scanning devices 17 face to the light-quantity-unevenness sensor 23 or Fig. 6 wherein the light-quantity-unevenness sensor 23 can detect light irradiated and reflected on the photosensitive drum 21 so that unevenness of light quantity can be detected. Light quantity that a copier directed to the present invention detects is half-tone-level light quantity likely to occur unevenness of light-quantity around development threshold area and maximum light quantity which effects on image density.

[0047] In Fig. 5, emission surfaces of the solid scanning devices 17 facing the photosensitive body 21to expose thereto are rotated in arrow d direction such as to reach for a position where the emission surfaces can face the light-quantity-unevenness sensor when unevenness of light quantity is detected based on control of the printer control section 23.

[0048] In Fig. 6, an emission surface of the solid scanning devices 17 facing the photosensitive body 21to expose thereto are rotated in arrow e direction such that light reflected on the photosensitive body 21 should go into detection surface of the light-quantity-unevenness sensor 23 when unevenness of light quantity is detected based on control of the printer control section 23.

[0049] Next, process for controlling light-quantity-unevenness detection will be described by referring to Figs. 7 and 8. Fig. 7 is a flow chart showing control proceeding from power-on to completion of warming-up and Fig. 8 is a flow chart for illustrating control proceeding with a light detection mode at S1 in Fig. 7.

[0050] As shown in Fig. 7, when power source of the main is turned on, light-quantity-unevenness detection mode starts up at S1 and then, worming-up is finished at S2.

[0051] In a light-quantity-unevenness detection mode at S1, as shown in Fig. 8, the sensor moving motor M1 (see Fig. 3) is driven at S11and the light-quantity-unevenness sensor 23 is moved in an arrangement direction of the solid scanning devices 17. Thereby, the light-quantity-unevenness sensor 23 gets set at a position to detect light quantity of pixels for the solid scanning devices 17. With this state, emission surface of the solid scanning devices 17 is set at a direction shown in Fig. 5 or Fig. 6 whereby light quantity is detected. As for movement of the light-quantity-unevenness sensor 23, all of the solid scanning devices 17 may be allowed to irradiate at a time when the light-quantity-unevenness sensor 23 starts moving or the solid scanning devices 17 may be allowed to irradiate in order along with movement of the light quantity sensor 23.

[0052] Next, the solid scanning devices 17 are allowed to emit with maximum light quantity at S12 and the light-quantity-unevenness sensor 23 detects the maximum light quantity at S13. The thus obtained maximum light quantity is converted into

digital data by the light-quantity-unevenness A/D converting section 60 (see Fig. 2) and then, the converted maximum light quantity data is transferred to light-quantity-unevenness memory 61. Next, at S14, sensor's return position detecting section 32 (see Fig. 3) detects whether or not the light-quantity-unevenness sensor 23 is positioned at a sensor return position (a position the light-quantity-unevenness sensor 23 is to face the sensor's return position detecting section 32).

[0053] If the light-quantity-unevenness sensor 23 is not at the sensor's return position (NO: S14), processing goes back to S11 wherein the light-quantity-unevenness sensor 23 is moved to the sensor's return position and detects maximum light quantity thereat. If the light-quantity-unevenness sensor 23 is at the sensor's return position (YES: S14), it is determined that the light-quantity-unevenness sensor 23 finishes detecting maximum light quantity of all the pixels. Furthermore, the light-quantity-unevenness sensor 23 moves to a position the solid scanning devices 17 are not located. Once a sensor's reverse start sensor detects the light-quantity-unevenness sensor 23, the sensor moving motor M1 reversely rotated at S15.

[0054] After that, light quantity of the solid scanning devices 17 is changed to a predetermined half tone light quantity and thus adjusted quantity of light is turned on at S16. The light-quantity-unevenness sensor 23 detects the half tone light quantity at S17. In accordance with the light quantity detected therein, data of the half tone light quantity is transferred to the light-quantity-unevenness memory 61 via the light-quantity-unevenness A/D converting section 60 similar to maximum light quantity data. Next, a sensor-home-position detecting section 31 (see Fig. 3) determines whether or not the light-quantity-unevenness sensor 23 is positioned at its home-position namely, a position where the light-quantity-unevenness sensor 23 faces to the sensor-home-position detecting section 31, at S18.

[0055] When the light-quantity-unevenness sensor 23 is not at its home-position (S18: NO), the processing goes back to S15 and half-tone light quantity is detected while the light-quantity-unevenness sensor 23 is being moved. When the light-quantity-unevenness sensor 23 is at the home-position (S18: YES), it is determined that the light-quantity-unevenness sensor 23 has finished detecting half-tone light quantity regarding all of the pixels, and then a light quantity correction table (mentioned later) is made at S 19 to finish this routine.

[0056] Unevenness of light quantity is detected by making the light-quantity-unevenness sensor 23 reciprocate. Maximum light quantity data and half-tone light quantity data stored in respective memory is processed pixel pixel at processing unit. Next, unevenness of light quantity is corrected in accordance with Fig. 9 and [Expression 1].

[0057] Fig. 9 is a diagram for illustrating a manner of light quantity correction exercised in this copier. In this copier, three kinds of light quantity data (exposure quantity data), namely, data of maximum light quantity, half-tone light quantity, and minimum light quantity (value when shipped from a factory), are used for each pixel at S19 in Fig. 8 so as to make a light quantity correction table for correcting unevenness of light quantity. Thereby, duty for driving solid scanning devices 17 for each pixel is changed.

[0058] Process of light quantity correction table making for this copier will be described along with (0) to (3) by referring to Fig. 9.

(0) Light quantity Eoff corresponding to an image data gradation Go is set as a minimum light quantity when this copier is shipped from a factory.

(1) The light-quantity-unevenness sensor 23 detects a light quantity Eon corresponding to a gradation Ga1 as maximum light quantity and a light quantity corresponding to a gradation Ghalf as half-tone light quantity while the copier is warming up such as in a manner of Figs. 7 and 8. As for image data other than the above, linearity is supposed: light quantity characteristics of image-data gradation for a solid scanning device corresponding to a certain pixel is supposed by linking points (Go, Eoff), (Ghalf, Ehalf), and (Gall, Eon) with straight line on a graph.

(2) Among a plurality of maximum light quantity Eon for solid scanning devices arranged in a row, the smallest light quantity is named Eonmin. Further, among a plurality of minimum light quantity Eoff for solid scanning devices arranged in a row, the largest light quantity is named Eoffmax. Still further, along with Ghalf, gradation of the image data, a predetermined light quantity, which may be the largest one, the smallest one, mean value and the like among image data corresponding to Ghalf for all of the solid scanning devices, is named Eref. By linking three points (Go, Eoffmax), (Ghalf, Ehalf), and (Gall, Eonmin) with straight line, light quantity correction curve for solid scanning devices is created. In this case, an approximate expression may be used to make the curve instead of liking points with straight line.

(3) Gradation Dn for determining light quantity for each solid scanning devices is passed on to Dn' as follows. Thereby, a light quantity correction table can be made. For example, when a photosensitive body is exposed in accordance with image data gradation Go, the gradation Go is replaced with a gradation Go' exposing at light quantity Eoffmax. Thereby, light quantity of Eoffmax on the correction curve can be obtained along with gradation Go.

[0059] Correction following such as the above process can be carried out by utilizing [Expression 1] indicated below. Here, image data read out by an image reader as the n-th pixel is named Dn, and correction image data is named Dn'.

[0060]

[Expression 1]

When Gradation is between 0 and Ghalf,

$$Dn = \frac{Ehalf - Eoff}{Eref - Eoff\ max} \times Dn + \frac{Eoff - Eoff\ max}{Eref - Eoff\ max} \times Ghalf$$

When Gradation is between Ghalf and Gall

$$Dn' = \frac{Eon - Eoff}{Eon\ min - Eref} \times Dn + \frac{Ehalf - Eref}{Eon\ min - Eref} \times (Gall - Ghalf)$$

[0061] In case of set-up time for changing light source lamps or normal warm-up time, at S19 in Fig. 8, a correction table for light quantity detection mode is made based on the above indicted expression wherein correction image data is calculated. When calculation is finished, warm-up of the solid scanning devices 17 ends.

[0062] Fig. 10 is a diagram for illustrating effects of the present invention. By thus correcting unevenness of light quantity, unevenness of light quantity shown in Fig. 15 is corrected such as in Fig. 10. Thereby, light quantity is made approximately constant regardless of difference of light quantity obtained by each light shutter element, namely, light shutter array A and light shutter array B.

[0063] As described the above, in the present invention, light quantity detection means movable in arrangement direction of solid scanning device is provided. Since the light quantity detection means detects light quantity of each pixel for the solid scanning devices with a predetermined timing, decrease of light quantity due to deterioration by long use or dirt can be corrected. Further, since the light quantity detection means detects light quantities including half tone light quantity, high-quality image can always be obtained even if with binary output. Still further, since light quantity is detected pixel by pixel, unevenness of detection never occurs.

[0064] In this embodiment, data for correcting unevenness of light quantity is created during normal warm-up time so as to make a light quantity correction table. However, unevenness of light quantity may be detected with timing such as after a predetermined sheets of copying is counted, or after a predetermined time lapses that does not affect normal image formation. Further, in case a plurality of light quantity regarding half-tone level is detected to correct inputted image data, accuracy of light correction is enhanced and reproduction of half-tone image can be improved.

[0065] In this embodiment, minimum light quantity is not detected. However, minimum light quantity may be detected so that correction accuracy of unevenness

of light quantity can be further improved

[0066] Still further, in this embodiment, unevenness of light quantity is corrected by detecting actual light quantities of the solid scanning devices 17. However, for detecting unevenness of light-quantity indirectly, latent images corresponding to maximum light quantity and half tone light quantity may be formed on the photosensitive body so as to detect unevenness of light quantity by detecting potential of the latent images. Thereby, light quantity can be corrected.

[Brief Description of Drawings]

[Fig. 1] A cross sectional diagram showing a schematic structure of a copier which employs solid scanning devices for its printer head.

[Fig. 2] A block diagram for illustrating how an image signal is processed from the line sensor 15 of Fig. 1 through the solid scanning devices 17.

[Fig. 3] A diagram for illustrating a schematic structure at the vicinity of the solid scanning devices 17 and light-quantity-unevenness sensor 23.

[Fig. 4] A diagram showing the solid canning devices 17 of Fig. 3 arranged in a staggered form.

[Fig. 5] A first diagram showing the light-quantity-unevenness sensor 23 in detecting operation and the solid scanning devices 17.

[Fig. 6] A second diagram showing the light-quantity-unevenness sensor 23 in detecting operation and the solid scanning devices 17.

[Fig. 7] A flow chart showing control proceeding from power-on to completion of warming-up.

[Fig. 8] A flow chart for illustrating control proceeding with a light detection mode S1 in Fig. 7.

[Fig. 9] A diagram for illustrating a manner of light quantity correction exercised in this copier.

[Fig. 10] A diagram for illustrating effects of the present invention.

[Fig. 11] A diagram for illustrating operation of each section of a printer head using solid scanning devices.

[Fig. 12] A diagram showing a light shutter driving circuit for driving a light shutter array 65.

[Fig. 13] A diagram for illustrating relationship between drive pulse voltage to be applied to the light shutter element in the light shutter driving circuit and light intensity of light which transmits the light shutter element.

[Fig. 14] A diagram for illustrating relationship between voltage V to be applied to the light shutter element and transmitted light intensity I of light which transmits an analyzer.

[Fig. 15] A diagram showing variation of light quantities obtained through the light

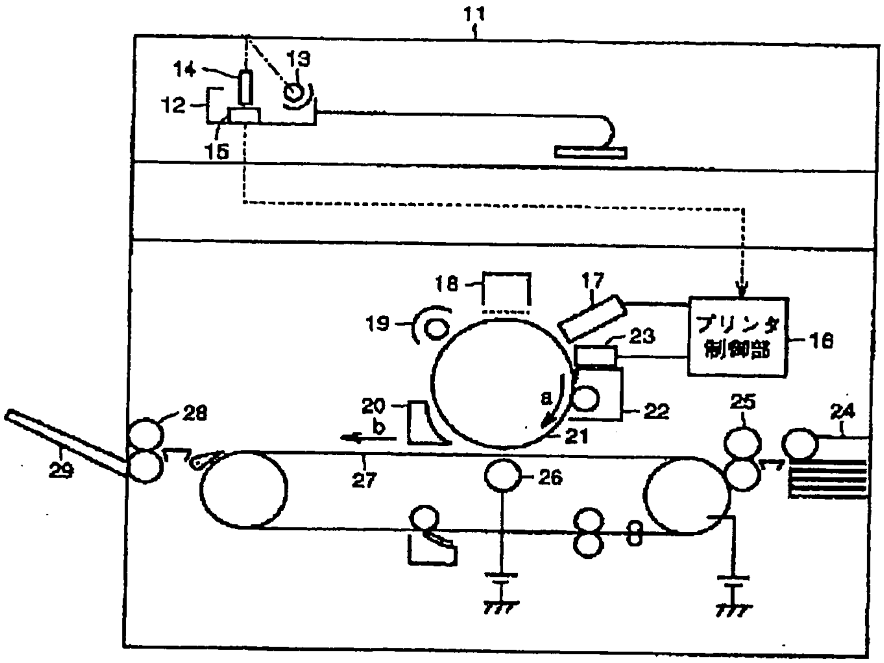
shutter element.

[Explanation of Reference Numeral]

17	Solid Scanning Device
23	Light-Quantity-Unevenness Sensor
30	Screen Shaft
31	Sensor's Home Position Detecting Means
32	Sensor's Return Position Detecting Means
M1	Sensor Moving Motor

[FIG. 1]

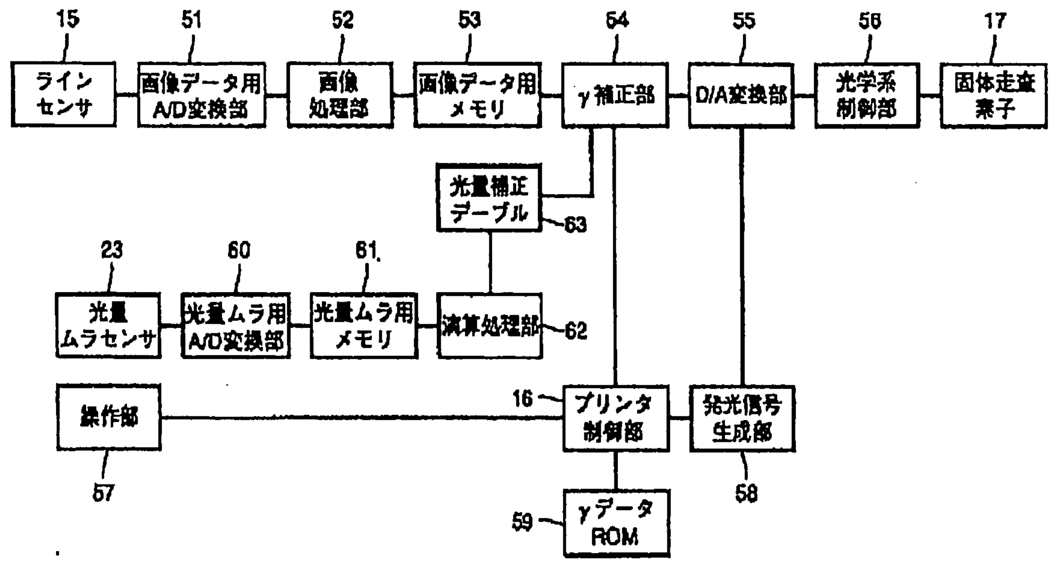
【図1】



16: Printer Control Section

[FIG. 2]

【図2】



15: Line Sensor　51: A/D Converting Section　52: Image Processing Section　53: Image Data Memory　54: γ -Correction Section

55: D/A Converting Section　56: Optical System Controlling Section　17: Solid Scanning Devices　63: Light Quantity Correction Table

23: Light-Quantity-Unevenness Sensor　60: Light-Quantity-Unevenness A/D Converting Section

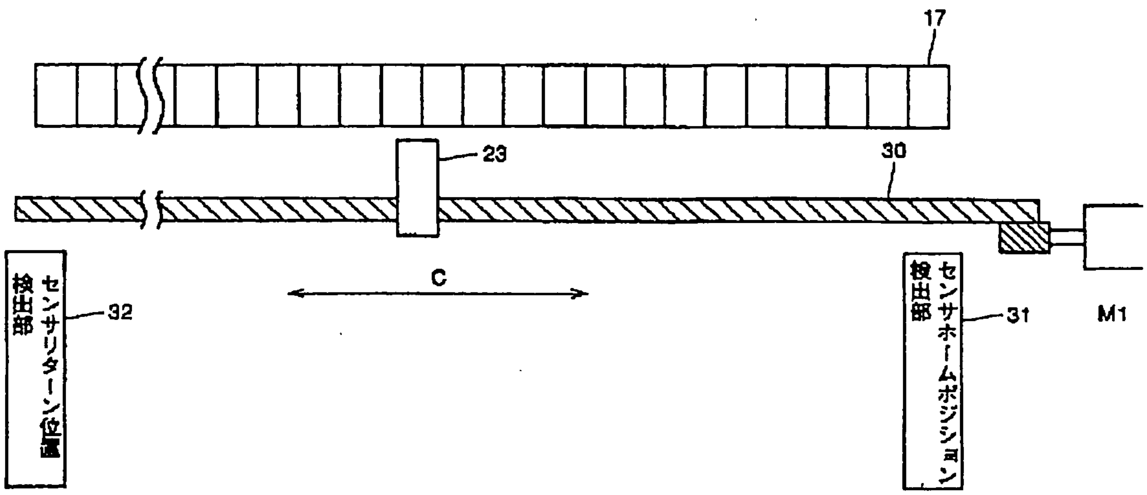
61: Light-Quantity-Unevenness Memory　62: Processing Unit

57: Operating Section　16: Printer Control Section　58: Emission Signal Generating Section

59: γ Data Rom

[FIG. 3]

【図３】

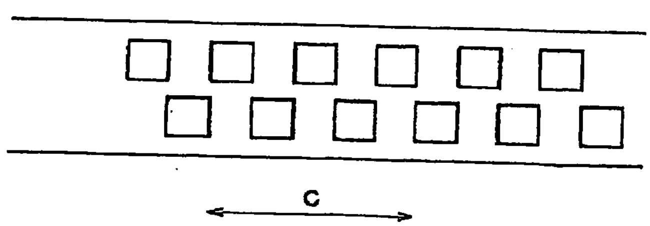


32: Sensor-Return Position Detecting Section

31: Sensor-Home Position Detecting Section

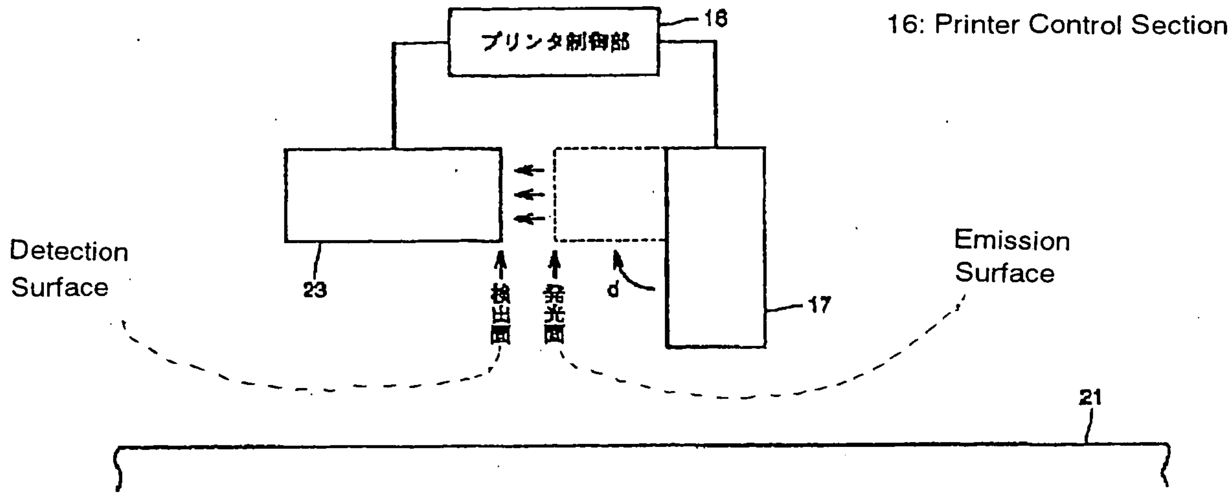
[FIG. 4]

【図４】



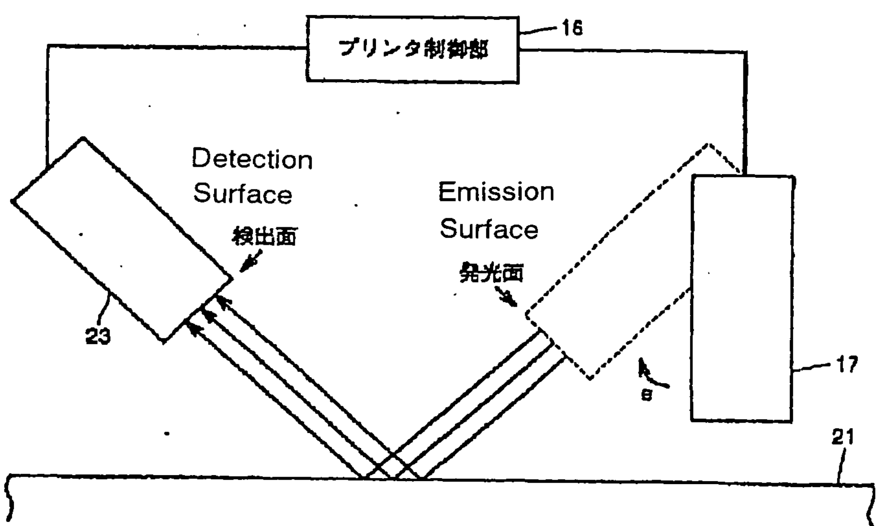
[FIG. 5]

【図 5】



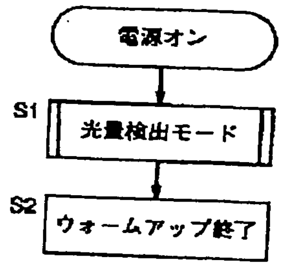
[FIG. 6]

【図 6】



[FIG. 7]

【図７】



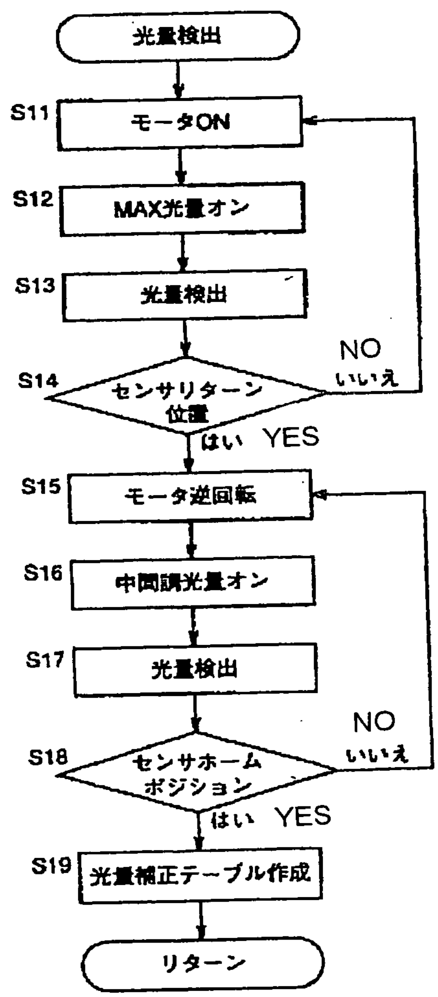
Power Source ON

S1: Start Light Quantity Detection Mode

S2: Finish Worm-Up

[FIG. 8]

【図８】



Light Quantity Detection

S11: Motor ON

S12: MAX Light Quantity ON

S13: Detect Light Quantity

S14: At Sensor Return Position?

S15: Rotate Motor in Reverse Direction

S16: Half-Tone Light Quantity ON

S17: Detect Light Quantity

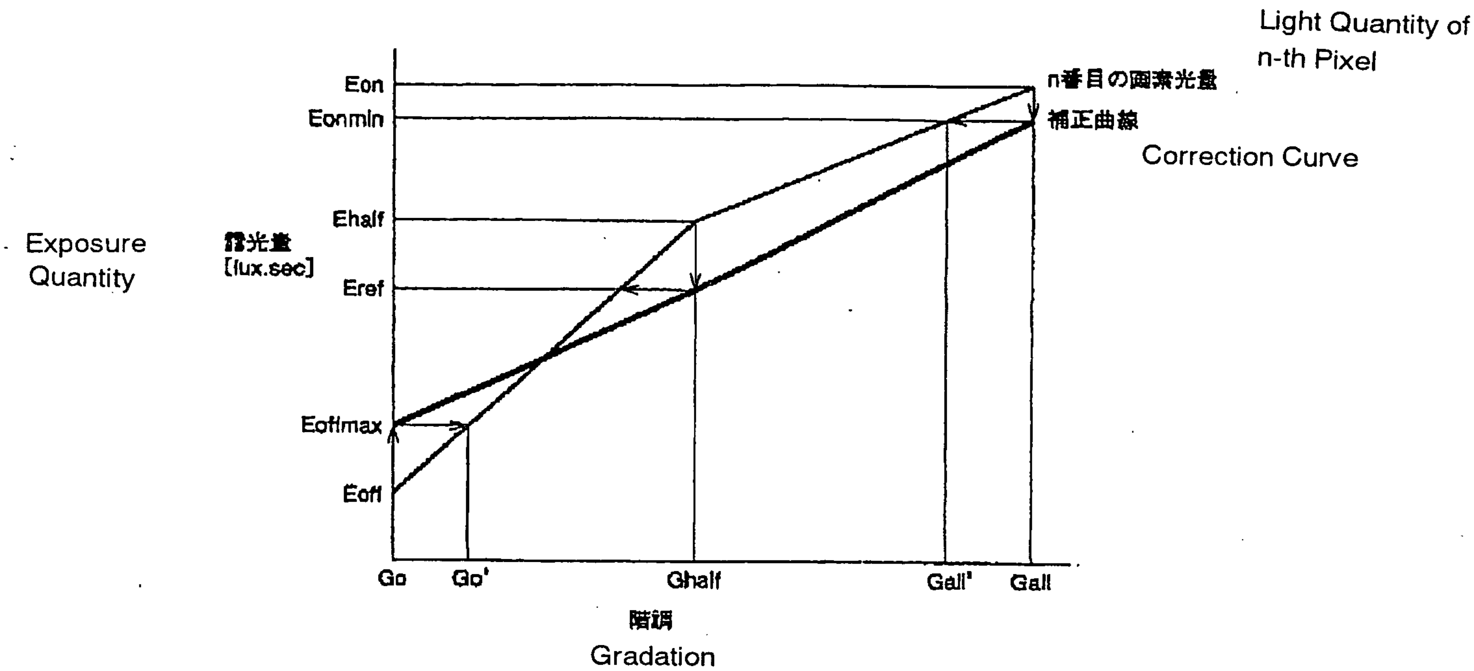
S18: At Sensor Home Position?

S19: Make Light Quantity Correction Table

Return

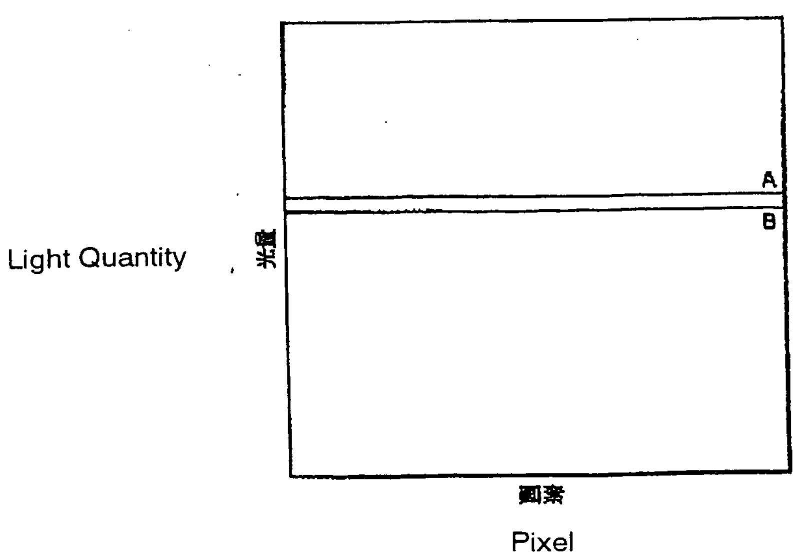
[FIG. 9]

【図９】

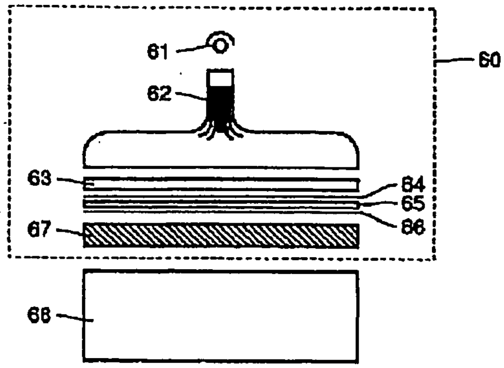


[FIG. 10]

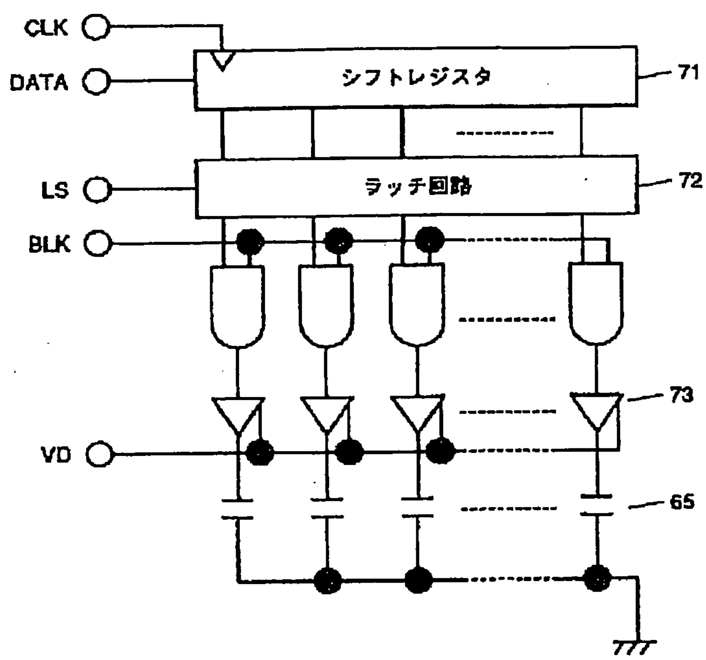
【図１０】



[FIG. 11]
【図１１】



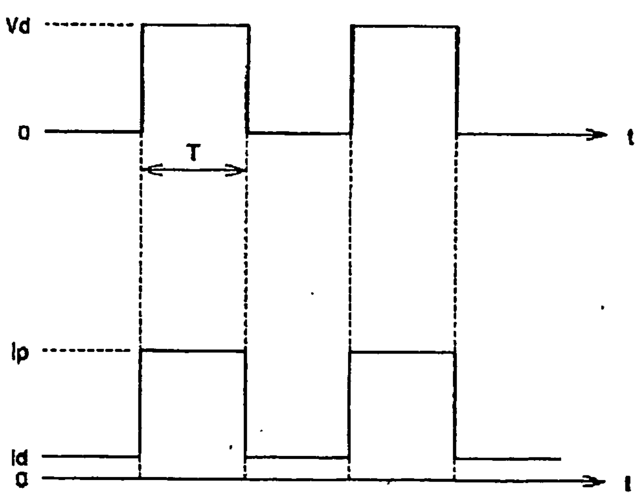
[FIG. 12]
【図１２】



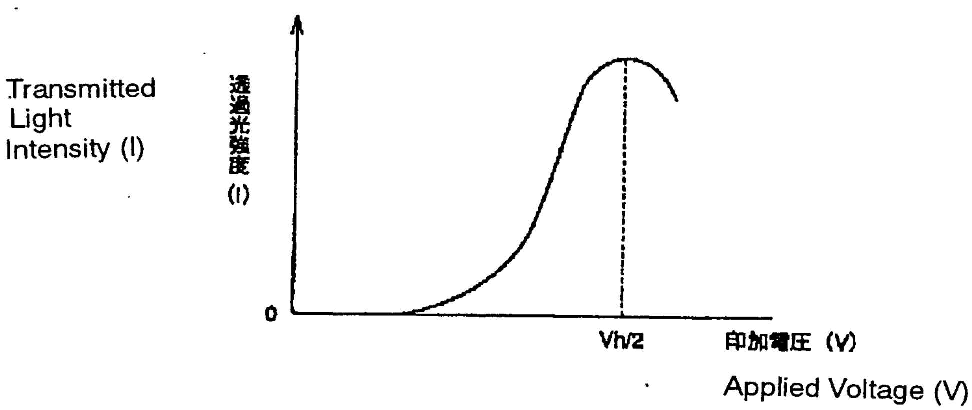
71: Shift Register

72: Latch Circuit

[FIG. 13]
【図１３】



[FIG. 14]
【図１４】



[FIG. 15]
【図１５】